J16 The Characterization of Vehicles Found in Ballpoint Ink Cartridges of Different Composition and Possible Implications on Ink Aging Examinations

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The goal of this presentation is to provide a greater understanding of the aging characteristics of ballpoint inks, as well as, to disseminate additional information regarding the possibility of classifying the cartridge type within a writing instrument based on the presence or absence of certain chemical compounds.

This presentation will impact the forensic science community by leading to a greater understanding of inks for document examiners and researchers.

All writing inks, in their basic form, are mainly composed of a colorant(s) that is suspended in a vehicle (solvents and resins). The vehicle is the fluid portion of an ink that suspends and delivers the colorant to the substrate. Once on the paper, the solvent in ink evaporates over a period of time causing the colorant to dry onto the paper. Glycols, alcohols, and water are the most commonly found solvents in use for pens today. The choice of which solvent to use often relies on properties related to the writing instrument. The writing instrument type (e.g., fountain pen, ballpoint, felt tip marker), the composition of the ink cartridge, the region of sale (e.g., dry, humid), and other considerations all factor in to the decision of which solvents are utilized.

The composition of an ink cartridge is a consideration by manufacturers when selecting solvents for ink formulations and can be plastic-based (e.g., polyvinylchloride, polyethylene, polypropylene) or metal (e.g. brass, stainless steel). As an example, benzyl alcohol cannot be used solely in polyethylene cartridges since it diffuses through the material causing the ink to dry. The detection of certain components in questioned ink entries may suggest the type of pen cartridge used to create the writing. This information may be helpful in reducing the potential population of writing instruments, especially in cases that involve the comparison of a suspect pen with a questioned document.

The analysis of solvents for the purpose of dating inks is well documented and has been reported in the literature for over two decades. More recently, studies have indicated that certain inks can be characterized as fast or slow aging. It is likely that aging parameters are directly affected by the combination of vehicle components. Therefore, it was hypothesized that the combination of ingredients found in the vehicle portion of an ink may be used to predict whether an ink is slow or fast aging.

In this study, research focused on characterizing the various solvents used in “plastic” and “metal” cartridges that are commonly used in ballpoint writing instruments. An analysis using gas chromatography/mass spectrometry, coupled with thermal desorption, was carried out on 100 cartridges (50 plastic and 50 metal) to determine if certain solvents, or a combination, are characteristic of cartridges having different compositions. In addition, an analysis was conducted on the inks after six months of drying to ascertain the significance of vehicle composition on the aging of ink.

The results from this study will lead to a greater understanding of inks based on their composition of the vehicle portion of ballpoint writing inks. The potential uses for this information may have a significant impact on the conclusions rendered in forensic reports. In addition, determining the age of inks based on solvent evaporation in written entries has been on the forefront in recent publications. Additional knowledge regarding the effects of vehicle components on the aging parameters of an ink will be invaluable to the forensic community.

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